

A Simple 300/1200 Baud Packet Radio Modem

*Lou Destefano VK3AQZ * after an unusual introduction to Packet Radio, now solves another problem.*

Just recently, I purchased the Pocket modem designed by Tom Moffat. This is a software TNC using Baycom or similar software and operating at 1200 baud. This baud rate is satisfactory for 28 MHz and above but not for HF packet. Although the Pocket modem is excellent for its intended application, it cannot be made to work at 300 baud. The TCM3105 chip can handle just about any baud rate, except 300. However there is a chip readily available that can handle 300 as well as 1200 baud. This is the AMD 7910 world-chip which can be programmed for Bell 103, Bell 202, V.21 and V.23. The disadvantage of this chip is the requirement for a + and - 5 volt

supply and the rather heavy current consumption of around 150 mA.

The circuit diagram of a dual baud rate modem using this chip is shown in Figure 1. The design is nothing really original and the basic circuitry is very similar to the TCM3105 modems such as Baycom, Poor Man's Packet, Moffat's, and a variety of other published circuits including ones using the 7910 chip. Most of the hard design work has been done by the chip manufacturer and there is only limited circuit variation possible external to the chip. The purpose of this article is to introduce to the reader, a software TNC modem suitable for both HF and VHF packet radio.

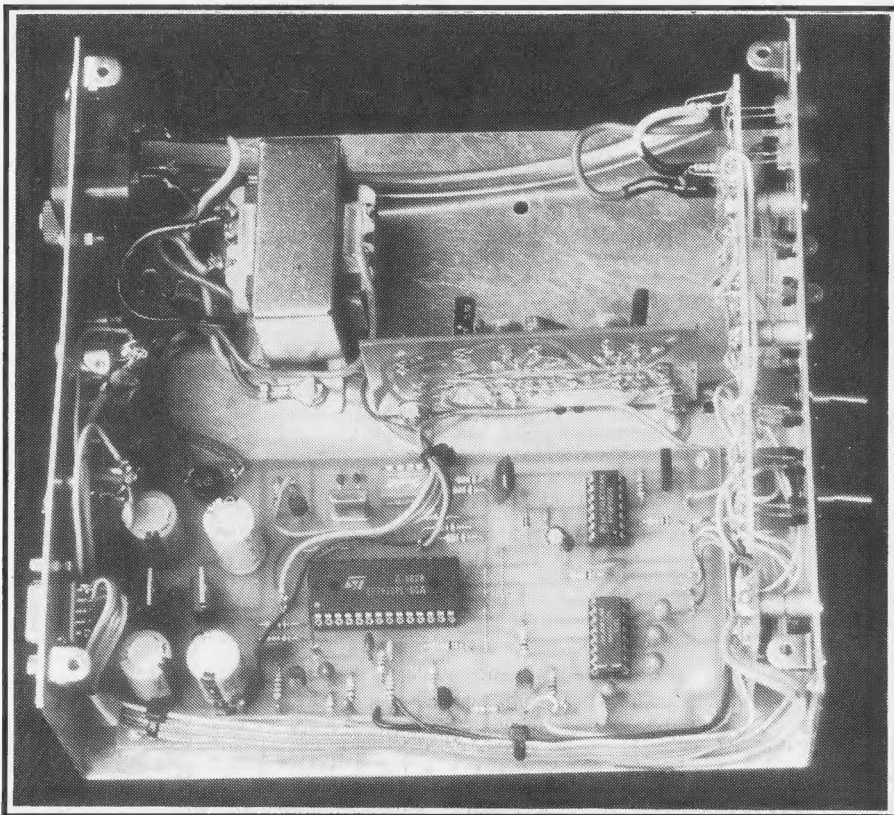
Circuit description

The 7910 modem chip is capable of receiving and transmitting FSK audio tones for a variety of modes which can be selected by applying the appropriate logic level at inputs MC0 to MC4 (pins 17 to 21). It can also be programmed for "loopback" mode. When using Bell 103 mode, the transmitted data is sent using one pair of audio tones whilst the received data uses a second pair of tones. If the sending modem is in the "Originate" mode, a space generates a 1070 Hz tone and a mark, a 1270 Hz tone. A modem in the "Answer" mode will reply with 2025 Hz for a space, and 2225 Hz for a mark. This enables duplex operation over a phone line. For amateur packet operation, the same pair of tones are used for both transmit and receive. Fortunately, the 7910 is able to transmit and receive on the same pair of tones at 300 baud by using the "loopback" mode, which was incorporated in the chip for test purposes. Loopback is selected by a logic high on pin 21 (MC4 input).

Bell 202 mode (1200 baud), uses the same tone pairs for transmit and receive with a back channel at 5 baud for the reply. An SPST switch wired to pin 18 of the 7910 selects either 300 baud or 1200 baud mode. The other 4 pins are programmed with a 4 pole dip switch on the pcb. If you prefer, this switch can be left out and wire links used instead. However, if you leave the switch in, you can experiment with some of the other modes. These are briefly described on the circuit drawing. For those interested, more information is detailed in the manufacturer's data sheets.

Input/Output Circuits

The received audio tones are fed into the modem via DIN sockets from the HF and VHF rigs. A set of small trim pots is used to adjust the receive and transmit tone levels. These trim pots are located on a small piece of matrix board mounted behind the front panel with small LED plastic bezels for neatness, and as screwdriver guides. In my set-up, audio from the HF rig (IC720A) is taken from the multiway connector at the rear and is independent of the front panel volume control. The



Side View of Modem showing main PCB, tuning indicator board, and rear of front panel.

transmit audio also enters the rig via the rear connector but still utilises the front panel Mic gain. The HF TX trimpot is set so that the transmitted power is roughly correct with the Mic gain control at the same setting as for voice. This modem transmits packet data as audio FSK and is fed into the transmitter audio input circuits. This method of transmitting FSK has limitations in that over-driving the audio input can generate unacceptable distortion products.

The setting of the transmit audio level needs to be carefully done by listening on another receiver, and ensuring the transmitted tones are relatively clean. Do not overdrive the rig in an attempt to get more apparent power, and definitely do not use a compressor. Use of an RTTY input, which directly controls an oscillator frequency, is a much better way of transmitting packet data. For packet operation, the frequency shift of this RTTY facility should, in theory, be reset for 200 Hz shift.

The audio take-off point at the rear connector of the IC720A has a

relatively high impedance necessitating a 10 k trimpot for VR2 to minimise the loading. For the VHF rig, the audio is derived from the speaker output. As for HF, the transmit audio tones are fed into the Mic input. VR3 is used to adjust the TX tone level and is set for a reasonable level of tone modulation without going into too much clipping.

Use of an RTTY input, which directly controls an oscillator frequency, is a much better way of transmitting packet data.

In this case, the setting is not as critical as for the HF rig. Listening on a second rig whilst adjusting VR3 will give you a good idea of the quality.

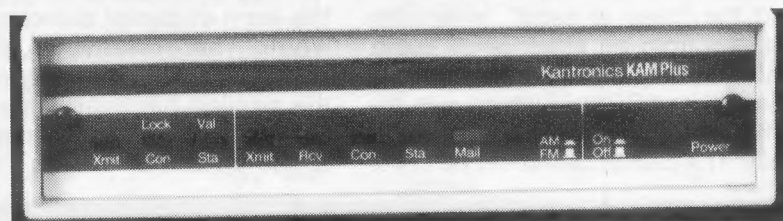
The selection between HF and VHF is made via S1a, b, and c. As 1200 baud is also used on 28 MHz, the 1200/300 baud selection could not be incorporated into this switch if full versatility was to be maintained. For receiving packet tones, the appropriately selected audio is fed

into a small 10 times amplifier so as to increase the level up to around 200 mV RMS. This amplifier stage is really only needed for the IC720A, which only gives 50 mV from the rear connector. On the other hand, the VHF rig speaker output supplies plenty of signal and may be too high if the receiver volume control is wound up.

This transistor amplifier also feeds a simple tuning indicator which I have incorporated into the modem. This indicator is only needed for HF packet. It is an essential addition if you want to spare yourself the pain of trying to tune in HF packet signals without one. The received tone frequencies for HF packet have to be tuned very accurately. The difference in frequency between the two tones is only 200 Hz and the exact tones are very difficult to pick by ear. If you alter the receive tuning during the short packet burst, you will not receive an output from your packet display. As the bursts are short and random, it can take considerable time before you fluke a correct decode.

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The tuning indicator I used is one designed by Garry Cratt and was published in Silicon Chip, April 91. It uses a pair of NE567 tone decoders each driving an LED. The NE567 is a PLL tone decoder and can be set up as a very selective tone detector. In this design, one chip is set for the space tone, whilst the other is set for the mark tone. The bandwidth of these detectors is very narrow resulting in an accurate packet tuning indicator. In operation, the rig is carefully tuned (in 10 Hz increments if possible) until both LEDs flash with packet data. If you intend using this design, I would strongly recommend the use of small 10 turn trimpots, or resistive padding, for setting the tone detector frequencies. The single turn trimpots are a little too touchy for the close spaced packet tones. The audio level required to drive this indicator is at least 200 mV RMS.

With regards to the reception of packet data by the modem, the software I am using waits for the activity on the data receive line to stop before it starts to send data out. On VHF, this occurs once the squelch operates and mutes the audio out of the rig. This in turn quietens the receive data line and the software knows it can send if required. On HF, there is no receiver squelch as such, and the "okay to send" is actually initiated from an absence of audio. Unfortunately, on HF, there is plenty of noise and QRM which causes the software to think that the channel is busy. The carrier detect circuit in the

7910 indicates a busy channel with a moderate level of noise.

In order to work successfully on HF, I have found it necessary to turn the RF/IF gain control down so that the packet data is recovered but the noise is low enough to allow transmission. Adjusting the pass band tuning also helps significantly. The modem really needs a packet detection system that ignores the noise and QRM. Some of the commercial units use an XR2211 as a PLL detector which then acts as a form of squelch if the correct tones are not received. In my particular modem, I have noticed that the tuning indicator LEDs do not come on very easily with noise alone. It really needs valid audio tone for the LEDs to come on. Although at this stage I have not tried it, it may be possible to derive a squelch type signal from the tune indicator output LEDs. This squelch could drive a transistor switch across the wire sending data to the computer.

As each LED flashes alternatively depending on whether it is receiving a space or mark tone, a one bit delay is needed. The voltages driving the two LEDs would then be "OR-ed" together, inverted, and applied to the squelch transistor. As most of the circuitry is already in the modem for this form of carrier detect system, it would be relatively easy to implement. An interesting article on this problem has been written by Eric S Gustafson, N7CL, presented as one of the papers at the 7th Computer

Networking Conference published by the ARRL.

The Computer Interface

The 7910 is driven by the computer via an RS232 interface chip. The particular software I am using is Graphic packet which is written for an IBM PC, or compatible, and makes use of the serial RS232 ports. Other software is available which can connect to a Commodore computer, or use the parallel interface. In my case, I am catering for an RS232 serial port, and thus I have used the versatile MAX232 chip. This chip has two TTL to RS232 converters plus two RS232 to TTL converters. In addition, it operates from a single 5 volt supply and internally generates + and - 12 volt RS232 signals. Alternative drivers are the 1488/89 chips but these require dual supplies, as well as stabilising capacitors. The single MAX chip does it all in one hit.

Some of the TCM3105 designs use standard MOS chips with high value series resistors to overcome the problem of blowing the chips up with the negative RS232 voltage swings. That's fine for short leads but unsuitable for longer cables and HF where high power rf can enter the connecting cables. The MAX chips have much lower input impedance and are thus more immune to interference. Whilst talking about HF applications, because of the powers involved, and the sensitive receive requirements, the use of well shielded leads and a metal box is a must.

The MAX chip drives the computer via a DE9S (Female) connector and uses the same pin numbers as the Moffat modem for compatibility. If your computer uses a 25 pin serial port connector please note that the function of the pins in the DE9 is not standard. If you purchase a standard 9 pin to 25 pin adapter or cable, you will have to rewire the cable. The connections are shown below :-
Note: The power function on pin 3 is only used in the Pocket Packet modem.

Function	DE9	DB25	Normal use
Tx Data	4	20	DTR
Rx Data	8	5	CTS
Ptt	7	4	RTS
Gnd	5	7	
Power	3	2	TXD

WIA News

Good publicity for amateur radio

It always pays to publicise your club's activities, and keeping in contact with the local newspapers in your club's area can pay dividends.

In August, when the Glen Innes and District (NSW) Amateur Radio Club opened its new headquarters at the town's railway station, the *Glen Innes Examiner* went along.

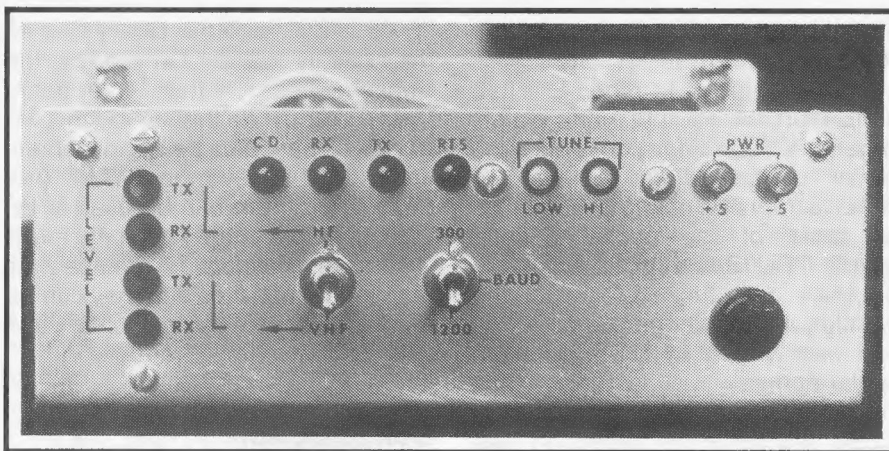
The result was a charming picture in the paper the next week and a short, complementary story

about the club and the hobby of amateur radio.

The picture showed foundation member, Ivan Botha, with his wife and baby daughter with the amateur equipment at the club's new headquarters.

Well done, Glen Innes and District Amateur Radio Club.

Such publicity keeps the hobby of amateur radio regularly before the public and helps dispel the many myths that abound about the hobby as well as to distinguish hams from CBers.



Front view of Packet Radio Modem.

In addition to the interface chip, a watchdog timer circuit is included to shut the transmitter down should a fault develop during unattended operation. This circuit is similar to other designs and works quite well. In some designs, an additional muting circuit is applied across the transmit audio output of the 7910 (pin 8). This muting is applied at the end of the packet data stream or when the watchdog timer activates. The rest of the circuit contains a simple dual supply and some LED indicators which display various modem conditions. Apart from the vital tuning indicator LEDs for HF packet, the rest of the LEDs can really be left out if you wish. If you decide to incorporate them, the LEDs flash away quite nicely during operation and can be entertaining to watch if nothing interesting is coming through on the screen.

With regards to the power transformer, I used a low cost (\$4) unit from Radio Parts rated at 300 mA. The particular unit I purchased was a multi-tap one but it did not have a centre tap at the voltage I wanted. However in this application it does not matter too much. If you are able to, it would be better if you could use a 9 V — 0 — 9 V transformer.

Software Considerations

The modem uses software which performs the TNC functions as well as the terminal facility. I have been using Graphic Packet (V1.21) by Ulf Saran (DH1DAE) which makes use of attractive icons, and is very user friendly. Graphic Packet uses a TNC program called TFPCX by Ren

Stange Y51GE. This software has been put in the public domain by the writers for use by amateurs, providing no commercial gain is made. All this software is for use with an IBM PC. I am using a 386 computer but the software can be used on a 286 and an XT. I have not tried it on an XT so I cannot comment on its use here. Other software, such as Baycom and SP, can also be used. SP and Baycom have a more basic screen display and appear very similar to each other. SP also uses the TFPCX software for the TNC function.

An important requirement of the software is the ability to configure it for both 300 baud and 1200 baud. I have both GP and SP working at both baud rates very successfully. Baycom V1.5 can be made to work at 300 baud by using the TNC command "HBAUD 300" after loading Baycom.

With regards to GP, I have two configuration files. One is set up for 1200 baud and I have named it CON1200.GP. The other is set up for 300 baud and is named CON300.GP. I boot up GP via a small batch file, and again I have two of these.

The 300 baud batch file is called GO300.BAT and the first line does a file copy from the 300 baud config file into CONFIG.GP, which is the file name GP looks for when it starts. The next line of the batch file does the same thing with the TFPCX part of the software which also needs to be configured according to the baud rate, as well as cater for some slight differences in TNC parameters. When working HF packet, some TNC parameters such as the TX delay time, the number of retries, and so on,

need to be fine tuned. Having two separate configuration files allows you to experiment with these parameters.

At this stage I must say I am still learning about HF packet and my set-up is probably not right yet. In addition to the copying of the specific configuration files, the batch file then loads the TFPCX software. When loading TFPCX, you can specify certain parameters such as which comms port you are using, the baud rate, and a switch which tells it to look for a specific initialisation file called TFPCX.INI. The next line then loads the Graphic packet running file called GP286.

For XT computers I believe you load GP in lieu of GP286. The last line of the batch file unloads TFPCX from memory after you exit GP. TFPCX resides in about 40k of RAM and runs in the background. In fact, with GP, you can exit to DOS via GP's DOS exit icon, and carry out other tasks on the computer whilst GP looks after any packet traffic.

For illustration, the 300 baud and 1200 baud "GO.BAT" files are shown below:-

```
GO300.BAT
Copy Con300.gp Config.gp
Copy Tfpcox300.ini Tfpcox.ini
Tfpcox -pcom2 -b300 -f
GP286
Tfpcox -u
GO1200.BAT
Copy Con1200.gp Config.gp
Copy Tfpcox120.ini Tfpcox.ini
Tfpcox -pcom2 -b1200 -f
GP286
Tfpcox -u
The TFPCX initialisation files are as follows:-
TFPCX300.INI
^T 100
^VK3AQZ
^F 5
^Y 5
TFPCX120.INI
^T 100
^R 1
^I VK3AQZ
```

In the TFPCX.INI files, the " ^ " is interpreted as an escape character and is used to signify a TNC command. "T" is the parameter for TX delay, and in my case is 100 msec. "I" sets up your callsign. "R" turns on the digipeater function. "F" is the

delay time for an answer in seconds, whilst "Y" specifies the maximum number of connect tries (default is usually 10). There are many other parameters you can play with. I am still learning in this area and have only scratched the surface.

When selecting either 300 or 1200 baud, it may be possible to do this from within GP itself. At this stage I have used the easy way out as above. The GP software is still a bit of a mystery to me. Up to just recently, the only documentation I had for GP was in German. I have to say that in the last month or so I think I learnt to read a significant number of German words! It's amazing how quickly you learn when you have to — particularly when your packet station automatically sends connect text or the "help" list in German! The ability to run both baud rates simultaneously with two comms ports, and dual modems would allow HF/VHF

digipeating which I guess is something to aim for in future.

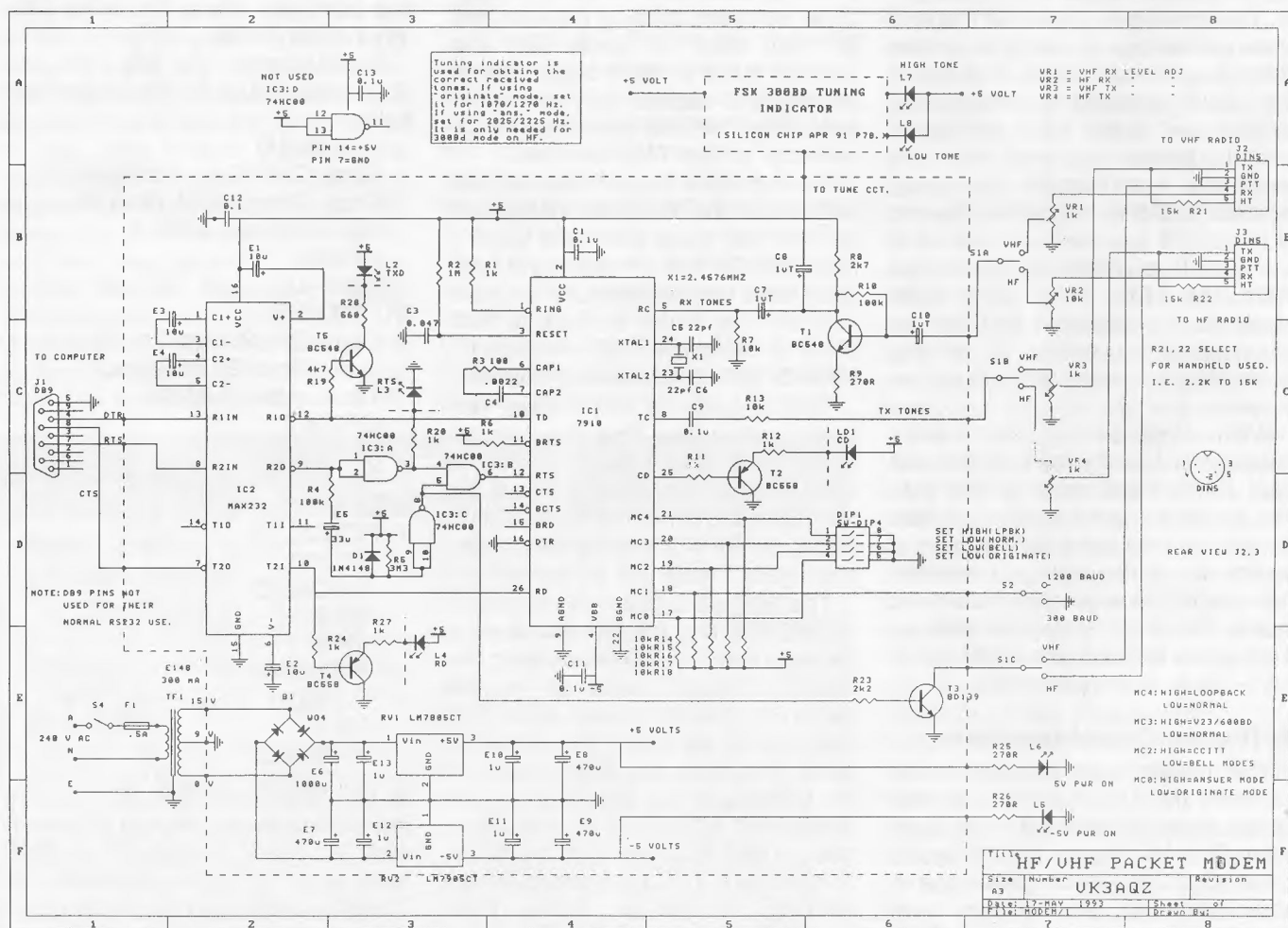
With regards to the English translation, we need to thank Waldis Jirgens, VK2DXV for converting the 40 or so pages into English. A "7PLUS" version of this document is on some of the packet bulletin boards. 7PLUS is an intelligent ASCII to binary encoding scheme for the transfer of files over packet networks and was written by DG1BBQ (also public domain for amateurs). It has the facility to correct for transmission errors and generate correction files which can be sent back to the source for re-transmission of just the missing bits. GP has an automatic 7PLUS file transfer system built in. Please note, however, that you need the 7PLUS program to convert the file back to its original condition. This 7PLUS program is not included with GP.

One thing I have not been able to do with either SP or GP, is down load

"EXE", "ZIP" or other binary files on the bulletin boards. On reading the English documentation, it appears that GP cannot do this, although it will transfer binary files between stations using GP. I believe the B-YAPP (not YAPPB) program can be used to do this but at this stage I can only make it work with Baycom 1.5. Please note that normal text files and mail can be read and saved using the GP text save facility.

Construction

The construction of the unit is straightforward. I originally built it "rat's nest" style on an old 7910 modem board designed for phone lines and it worked okay. I don't believe the layout is very critical and it could probably be built on matrix board. I have built mine on a single sided pc board using the Protel software to lay it out. There are only



three links on the top and the in/out pins were placed around the board where it suited. Take careful note of the orientation of the electrolytic capacitors around the MAX chip. If anyone would like a Protel PCB file, I can supply it, providing you send sufficient to cover postage and disc costs.

The case must be metal and earthed to reduce interference. Mine is made out of 2 pieces of 16 gauge aluminium bent as matching upper and lower "U" pieces. Size is 7" by 7" by 2.5" high (180 x 180 x 64 mm). I placed a couple of 0.001 μ F ceramic disc capacitors from the TX audio pins of J2 and J3 to earth as a precaution against RF feedback. Ferrite beads were also put over the wires joining these pins. Also, some handheld radios use a resistor to ground from the TX audio input to activate the PTT. These can be wired to the rear of J2 and J3 for convenience. To use these resistors, you need to join pins 5 and 3 in the mating plugs. This joins the PTT output from T3 to the bottom of the resistor only when the appropriate cable is plugged in. I use an FT470 and found that 2.7 k is required. I have shown these resistors on both sockets which allows you to use the HF socket for a handheld on 70 cm. Motherhood statement — don't leave out the mains fuse, wire the mains correctly to the switch, and use plenty of heatshrink for safety. Do not use a power cord without an earth if you use an all-metal box.

The tuning indicator is powered from the +5 volt rail. Referring to the original Silicon Chip article, the 8.2 V zeners are left out and the 120 ohm series supply resistors are reduced to 27 ohm. The input coupling capacitor is increased to a 1 μ F tantalum.

Alignment

The alignment of the modem is relatively easy. The receive levels into the 7910 are set with VR1 for the VHF rig and VR2 for the HF rig. Starting with the VHF circuit first, set the rig's volume control at about the level you normally use for voice, and with the trimpot wound right down, slowly bring it up until the software starts to decode packet reliably. Once you find this spot, you can turn VR1 up a little

more and leave it. Do some tests with noisy signals and see how well it can decode. I found the 7910 very good under noisy conditions and it seemed to be better than the TCM3105. The application notes for the 7910 indicate that the receive circuits contain both analogue and digital filtering. In addition, on 1200 baud, it contains an inbuilt equaliser which can be activated by putting MC0 at logic high. This pin has a dual role.

The alignment of the modem is relatively easy.

When 1200 baud is selected, setting it high turns a receive equaliser on. In the 300 baud mode, it selects whether you are in originate or answer mode. I did not find much difference between equaliser on or off so I have not used that facility. However the difference between originate and answer at 300 baud is very significant as it determines the tone frequencies.

Aligning the HF receive is more difficult as it requires you to have tuned the rig to the correct tones. To start with, set VR2 sufficiently high to activate the carrier detect LED. Then, using the tune indicator circuit, tune carefully till you obtain a correct decode. Once you find the correct receive frequency for the signals, adjust VR2 up and down, noting the point at which the signal will no longer decode correctly. The 7910 is able to withstand a reasonable level of input

signal, so once you have sufficient for decoding, you can advance it somewhat higher.

The tune indicator works at its best when it is fed with at least 200 mV rms and so this needs to be considered when setting VR2. The alignment of the tune indicator is as per the Silicon Chip article. Briefly, the trimpots for each NE567 are set with a frequency counter on pin 5 of the NE567's and the 22 k trimpots are then adjusted for the mark and space tone frequencies (with no input signal applied). The tone frequencies you adjust for depend on whether you use "originate" or "answer" mode.

When tuning in a packet signal, or any FSK signal with a sideband receiver, the resulting audio output frequencies will depend on the beat between the BFO and the incoming signals which represent the mark and the space RF carriers. If an SSB transmitter is fed with audio tones from a modem set up for originate, it will receive into its Mic circuit a 1070 Hz for a space and 1270 Hz for a mark. If the transmitter dial is set at exactly 14.100 MHz, then this frequency represents the frequency of the suppressed carrier. If the mode of the transceiver is lower sideband, then only the lower sideband components of the modulation will be output (due to the sideband filter).

This means the modem audio tones for originate mode would appear at 1070 Hz (space) and 1270 Hz (mark) below 14.100 MHz. Similarly, if the upper sideband mode is selected, the tones will be correspondingly above the nominal

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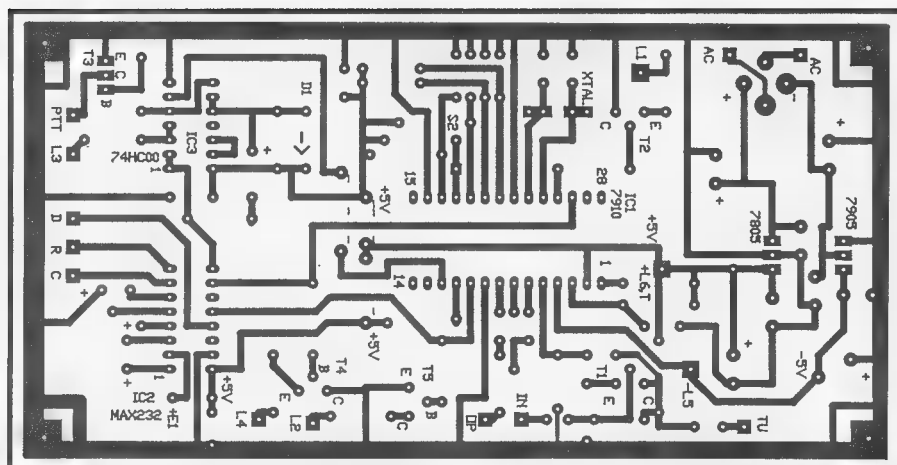


Figure 2 — Modem bottom layer, copper side view.

14.100 MHz carrier frequency. In both cases there will be two signals radiated which alternate on and off and are 200 Hz apart. Their absolute frequency depends on whether USB or LSB is used. Therefore, in the above example, we will have, whenever a space is sent, a signal at 14.100 MHz minus 1070 Hz, and when a mark is sent, a signal 1270 Hz below 14.100 MHz. A bit like two CW signals that are taking it in turn and 200 Hz apart.

If a receiver now comes across these two signals, and it is switched to the LSB mode, the frequencies that appear at the audio output of the receiver depend on the beat between the BFO and the two signals. When the tuning dial of this receiver reads exactly 14.100 MHz, the tones will be as above. If, however, the tuning dial is set at 14.101 MHz (ie 1 kHz higher), the tones will also be 1 kHz higher and appear as 2070 Hz and 2270 Hz. If the receiver happens to have a modem on the end of it which is switched to the answer mode, the two frequencies received are almost the same as those used for 300 baud in the answer mode and will thus decode as valid marks and spaces. In fact, at exactly 955 Hz above 14.100 MHz, the correct tones for 300 baud "answer" mode will result (ie 2025 Hz for a SPACE and 2225 Hz for a MARK).

Taking it a step further, if the operator of this receiver now switches his modem to originate mode, he will no longer decode the packet data whilst he is tuned to 14.100955 MHz. If he now re-tunes his receiver down

by 955 Hz to 14.100 MHz, he will again begin to decode the data correctly. So, in essence, it does not really matter if you are in originate mode or answer mode when receiving packet providing you understand how to read your tuning dial and adjust accordingly.

The essential thing is that the BFO beats with the incoming signal to produce the correct tones for the modem setting. A similar effect happens if the receiver in the above example is switched to USB. In this case the space and mark tones will be reversed and the dial reading, which represents the suppressed carrier frequency, will read lower than 14.100 MHz by the amount of the higher tone frequency (which decodes as the lower tone, if you follow!).

If you draw the above out as a spectrum representation showing the suppressed carriers, it will all become clear — I hope!. I understand that the convention on the 20 m band is to use LSB. In my case I have elected to use the modem in the originate mode which means that the audio tones are 1070 Hz and 1270 Hz. This means my tuning indicator has the two tone detectors set for responding to these two tones. So if the tune LEDs are flashing I know I am receiving 1070 Hz and 1270 Hz.

I don't take much notice of the tuning dial (other than to make sure I am in band), but I do know it is reading correctly if the sending station is using originate tones, and 955 Hz low if they are using answer tones. The important thing is the 200

Hz difference, not the absolute frequency values. This effect, if you can call it that, is a result of using single sideband radio equipment, and is not applicable to telephone baseband usage.

In my particular case, I am using the originate mode as the tone frequencies are lower and thus more easily handled by the narrower SSB filter in the rig.

The transmitter alignment is fairly straight forward. The correct tones are automatically generated on transmit by the 7910, depending on the chosen mode. With the pocket modem software, there was a very handy alignment program which generates spaces, marks, or reversals. Using this program, I was able to set the levels into the two rigs whilst listening on another receiver. The transmitters are feeding dummy loads during this process. It can also test if the watchdog timer is working as well as the PTT circuit.

The modem can also be checked and aligned at the computer connector (J1). First put a logic high on the PTT activating circuit. This is pin 7 on J1 and is called RTS. I did this by taking this pin to +5 volts via a small switch. The switch is needed to reset the watchdog timer which turns things off after 30 seconds or so. Strictly speaking, logic high at J1 should really be +12 volts as we are dealing with RS232 levels here. However, +5 seems to work today.

Pin 4 of J1 (DTR) is the pin which takes transmitted data from the computer and feeds it to the modem for generating the transmit audio tones. We need to check that RS232 highs and lows produce the correct tones. A logic low on pin 10 (TD) of the 7910 generates a space tone whilst a logic high generates a mark tone. Between J1 and pin 10 of the 7910 there is a logic inverter, which is one of the buffers in the MAX chip. Therefore, the logic at J1 pin 4 is reversed. During operation the software takes this reversal into account.

So, bearing in mind the above, if you put +5 volts on pin 4 of J1, you should obtain at pin 8 of the 7910 the tone for a space and for a logic low (-5v), the mark tone. The frequency of the tones depend on whether you

are using the answer or originate modes. In the originate mode you should get 1270 Hz for -5 V and 1070 Hz for +5v, and in the answer mode you should get 2225 Hz for -5 V and 2025 Hz for +5v. For 1200 baud mode you should get 1200 Hz for -5 V and 2200 Hz for +5 V with no difference between originate and answer.

Addendum

The foregoing packet modem design requires a modification to prevent some handhelds going into transmit when the TX audio plug is inserted into the Mic input of the handheld. A small mono block or similar capacitor of around 1 μ f needs to be inserted between pin 1 of the 5 pin DIN socket (J2) and the top of VR3. This capacitor provides DC isolation for HTs which go into transmit when a resistor is placed between the external Mic input and ground. Unfortunately, the value of VR3, being only 1 k, is too low for some units and causes the HT to go into transmit all the time. The HT should only transmit when the Mic input is earthed via R21 and the TX switching transistor, T3.

References

1. The "Pocket Packet modem", T. Moffat, Electronics Australia, Jan '93.
2. ARA super modem, T. Tregale & K. Summers, ARA Vol. 10 No. 1
3. An LSI Modem for Amateur Radio, ARRL Handbook 1986, Chapter 29.

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WIA News

Is this a record net?

The Coral Coast Group may be the longest running net in Australia, or perhaps the world, according to Les Daniels, VK2AXZ. It has been running 7 days a week since it was started by Les Bell VK4LZ in September 1967.

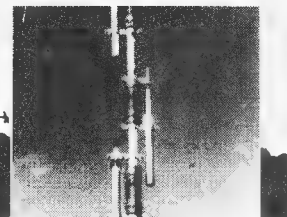
The dedication and enthusiasm shown by Les Bell and his wife was acknowledged by the Coral Coast Group, on the silver anniversary of the foundation of the net, with the presentation of a plaque to Les.

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■ Digital

A PLL Carrier Detector for the 7910 Packet Modem

Lou Destefano VK3AQZ further improves his packet modem.*

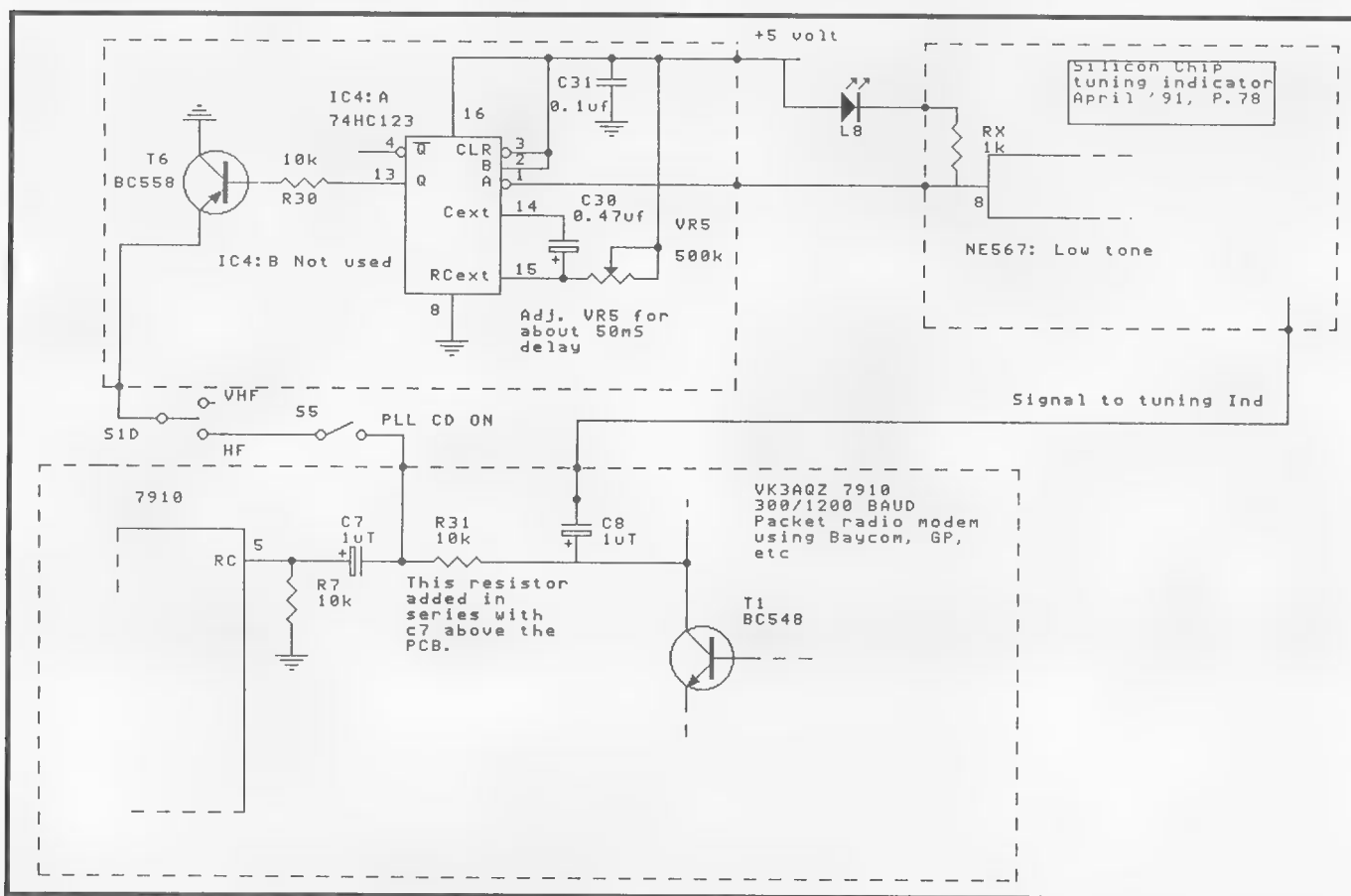
The 7910 300/1200 Baud packet radio modem uses the carrier detector function within the 7910 chip for determining channel activity. Some software uses the chip's carrier detected squelch to commence transmission. In addition to the presence or absence of data, Baycom also uses software bit count detection, and this can be selected by setting the Carrier parameter to 0 or 1. Because the 7910 was designed for telephone line use, the carrier detect circuit triggers with moderate levels of noise, and thus prevents the

software from commencing transmission, even though the channel is clear of packet signals. Software detection is an improvement, but still not satisfactory. This problem mainly affects HF packet. VHF packet normally uses FM, which uses a separate mute in the receiver, and thus does not present a problem.

The modem circuit I built incorporated a tuning indicator system published in Silicon Chip, which uses a pair of phase locked loop chips (NE567) as narrow band

tone detectors. It was noticed that the tuning indicator LEDs did not come on with noise as readily as the carrier detect LED on the 7910. Because the NE567 is a PLL device, a tone needs to be received before it locks up properly. Using this information, I built a simple interface between the tuning indicator and the 7910 which acts as an audio squelch into the 7910. The circuit consists of a re-triggerable monostable (74HC123) which is driven by the NE567 and turns a squelch transistor off in the presence of one of the packet tones.

The tuning indicator uses one PLL chip for the packet low tone and one for the packet high tone. It was found that it was only necessary to interface to one detector and a small delay used to span the time interval of the other tone. The delay was also necessary to stop the squelch transistor pulsing the input to the 7910 at the data rate and confusing the modem. After some experimentation, I adjusted the timing trimpot for around 50 to 100 msec. If this time is too long, your transmission delay will be extended, which will slow up the



data throughput. The 74HC123 consists of two monostables and it was intended to use one for each tone. However, this is not necessary and so the other one is left unused.

The output of the monostable is fed into a PNP transistor (T6) which is connected to the junction of the coupling capacitor feeding the input of the 7910 (pin 5), and a resistor going to the collector of the amplifier transistor, T1. Resistor R31 is added by removing the positive lead of the 1 μ f Tantalum capacitor from the pcb, and placing the resistor between this flying capacitor lead, and the pcb hole. Make sure the resistor goes into the correct hole which takes it to the collector of T1 and effectively provides DC power to the squelch transistor. If you have a CRO, connect it to the junction of R31 and C7 and observe the unmuting action of T6 when the low tone LED lights up. Adjust VR5 so that there is no pulsing at this point with packet data, and a suitable delay exists after the tone drops off.

The monostable input is derived from pin 8 of the NE567 and this point goes low when the correct tone is received. It is a negative going pulse and so it is fed into the negative trigger input of the 74HC123. The Q output of the 74HC123 is used to drive the PNP squelch transistor. When the Q output is low, T6 is turned on and effectively shorts the incoming audio to ground. When the Q output goes high, the transistor turns off and the audio is allowed to enter the 7910. I could have tried to squelch the TTL side of the 7910 output, but I was concerned about the effect of pulsing the data line on and off. However, the extra delay available using that method would be beneficial. With the method used here, you can observe the carrier detect LED coming on and off, which is handy when setting the receive level. After the addition of this circuit, I find I can turn the audio level up considerably higher before noise starts to affect the packet transmission.

The muting transistor connects to

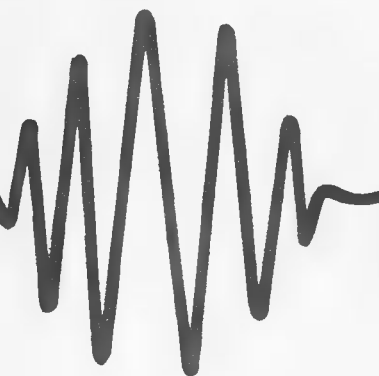
the main pcb via an on/off switch and a fourth pole of the VHF/HF selector switch. This disables the muting function on VHF as it is not needed. The other switch was added so that I could observe the effectiveness of the mute, and also disable it if I felt it affected the receive in any way. In practice I now leave it on all the time. As there are only a few parts I built the unit on a small IC test pad PC board that you can buy from Tandy and other electronics hobby suppliers. A piece of matrix board would also suit.

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